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bulletin bulletin

SGWU CENTRE FOR INSTRUCTIONAL TECHNOLOGY

SOME ALTERNATIVES FOR UNIVERSITY SCIENCE & ENGINEERING INSTRUCTION

1.0 BIBLIOGRAPHY

.1 An up to date comprehensive review paper:

McKeachie, W.J. 'Instructional Psychology', reprint #214, Annual Rev. of Psychology, 25, pp. 161-193 (1974).

.2 A sort of 'consumers report, study on the' Keller Method:

Cook, D.A. 'Personalized System of Instruction: Potential & Problems', Educational Product Report #61, June (1974).

.3 A sound theoretical basis for instructional science:

Frank, Helmar Kybernetische Padagogik, Deutscher Taschenbuch Verlag, 1971, Munich W. Germany.

.4 Goldschmid, B. & Goldschmid, M.L. 'Modular Instruction in Higher Education, a Review', Higher Education, V.2, pp. 15-32 (1973).

(See also The McGill CLD Bulletins)

.5 Kreitler, H. & Kreitler, S. 'The Role of the Experiment in Science Education', Instructional Science, V. 3, pp. 75-88 (1974).

.6 Blum, R. Ed. COMPUTERS IN UNDERGRADUATE SCIENCE EDUCATION (U.S.) Commission on College Physics (1971).

.7 Kalman, C.S. (Loyola Coll. Concordia Univ.) 'Introductory CAI dialogue in differential calculus for freshman physics', Amer. Jour. Physics, V. 42, pp. 392-395 (1974).

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.8 Also see the NEWSLETTER OF THE ASSOCIATE COMMITTEE ON INSTRUCTIONAL TECHNOLOGY, N.R.C. CANADA, for another paper by Kalman &c.

.9 A radical approach to the conduct of student apprenticeship to research, & community involvement in university research. Boyd, Gary M., 'Educational Technology for the Transparent University', pp. 17-20, in PROCEEDINGS OF THE (U.S.) NATIONAL CONFERENCE ON OPEN LEARNING IN HIGHER EDUCATION (1974).

2.0 THE PROBLEM OF INSTRUCTION

.1 The DESIRED OUTCOME is a student/researcher committed to an area of physics, and capable of making contributions or applications in that area (at least).

.2 The STARTING POINT is with intelligent college 'enrolees' who may have very little notion of what 'doing physics' means, who may or may not be numerate, whose motivation may lie as much in the direction of mathematics or philosophy or engineering or even teaching as in the direction of physics per-se. His cognitive style may be 'serialist' or it may be 'wholist'; he or she may be extroverted or introverted, or have a high or a low anxiety trait &c. &c.SUFFICE TO SAY THESE PEOPLE WON'T BE A HAND-PICKED HOMOGENEOUS GROUP.

.3 The ACTUAL PROBLEM is to develop learning activities which will help these variegated enrolees transform themselves into physicists of one sort or another.

.4 To specify a learning activity, a set of ranges of values of what Helmar Frank calls the DIDACTIC VARIABLES have to be specified:

I GOAL capabilities to be achieved by students

II CONTENT the particular knowledge, skills, critical and valuational abilities - 'subject-matter content'

III Entering STATE of the learners
- what do they already know?
- anxiety state? -fatigue?-satiation?

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IV Characteristic TRAITS of the learners
- wholist or serialist?
- achievement oriented?
- anxiety trait?

V SOCIOSTRUCTURE large group, or small group, or partners, or solitary, or personal tutorial &c.

VI MEDIA - Books, Blackboard Computer A-V aids discussion, Lab equipment &c.

VII STRATEGY - Instructional Algorithms and Heuristics specifying
- locus of control = learner, or tutor, or machine
- sequence of activities.

3.0 Conjectured SOLUTIONS

(for weaknesses & results see papers mentioned)

.1 MODULARISATION Since differing learning activities are needed for differing students as well as for a varied range of topics the complex array of activities can be managed and dovetailed by some form of modularisation or packaging of an engineered sort. (vid. Goldschmid & Goldschmid)

.2 PEER TEACHING Only by employing some more advanced students to help teach other more junior students can enough variety of interaction be supplied to meet the needs of the majority of the students. An outstanding example of this is the 'Keller Method' whereby senior students coach and test juniors, the seniors being credited &/or paid for doing so. (vid. Cook, 1974)

.3 COMPUTER MANAGED INSTRUCTION Only by employing computers to administer self-tests and keep track of where everybody is at can the complexity of providing appropriate tests, diagnostics and learning modules to large numbers of heterogeneous students be managed. (vid. Blum, also Kalman)

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.4 COMPUTER BASED LEARNING AND RESEARCH By employing computers as the basis for open forums in which simulated experimental work &/or real research projects are carried out the emphasis can be kept on 'doing physics' rather than getting bogged down in mathematical or laboratory techniques. The simplest version of this is a computer simulation of a classical experiment, e.g. Hookes Law. Then dialog may be written around this and contributed to by the students and other similar problems may be added. Then one can build up sort of annotated collective notebooks on real research projects, with selective access to knowledgeable students. (vid. Boyd, 1974)

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